

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

Claims 1-25 (canceled)

Claim 26 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a semiconductor film on an insulating surface;

providing said semiconductor film with a catalyst metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of the semiconductor film;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization; and

heating said semiconductor film and said gettering layer at a temperature from 500°C to 800°C in order to getter the catalyst metal in said semiconductor film using said gettering layer.

Claim 27 (Previously Presented): A method according to claim 26 wherein said semiconductor device is a photoelectric conversion device.

Claim 28 (Previously Presented): A method according to claim 26 wherein said heating to getter the catalyst metal is continued for 1-4 hours.

Claim 29 (Previously Presented): A method according to claim 26 wherein said gettering layer comprises a phosphorus silicate glass containing phosphorus at a concentration of 1 to 30 wt%.

Claim 30 (Previously Presented): A method according to claim 26 wherein said gettering layer comprises silicon containing phosphorus at a concentration of 0.1 to 10 wt%.

Claim 31 (Canceled)

Claim 32 (Previously Presented): A method according to claim 26 wherein said catalyst metal is selected from the group consisting of Ni, Fe, Co, and Pt.

Claim 33 (Previously Presented): A method according to claim 26 further comprising a step of removing said gettering layer after the gettering.

Claim 34 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a substantially intrinsic semiconductor film on an insulating surface;

providing said semiconductor film with a catalyst metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization; and

heating said semiconductor film and said gettering layer in order to getter the catalyst metal in said semiconductor film by said gettering layer.

Claim 35 (Previously Presented): A method according to claim 34 wherein said semiconductor device is a photoelectric conversion device.

Claim 36 (Previously Presented): A method according to claim 34 wherein said heating to getter the catalyst metal is continued for 1-4 hours.

Claim 37 (Previously Presented): A method according to claim 34 wherein said gettering layer comprises a phosphorus silicate glass containing phosphorus at a concentration of 1 to 30 wt%.

Claim 38 (Previously Presented): A method according to claim 34 wherein said gettering layer comprises silicon containing phosphorus at a concentration of 0.1 to 10 wt%.

Claim 39 (Previously Presented): A method according to claim 34 wherein said catalyst metal is selected from the group consisting of Ni, Fe, Co, and Pt.

Claim 40 (Previously Presented): A method according to claim 34 further comprising a step of removing said gettering layer after the gettering.

Claim 41 (Previously Presented): A method according to claim 34 wherein said heating to getter the catalyst metal is conducted within a temperature from 500°C to 800°C.

Claim 42 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a semiconductor film on an insulating surface;

providing a catalyst metal-containing material on said semiconductor film;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization; and

heating said semiconductor film and said gettering layer in a nitrogen atmosphere in order to getter the catalyst metal contained in said semiconductor film by said gettering layer.

Claim 43 (Previously Presented): A method according to claim 42 wherein said semiconductor device is a photoelectric conversion device.

Claim 44 (Previously Presented): A method according to claim 42 wherein said heating to getter the catalyst metal is conducted for 1-4 hours.

Claim 45 (Previously Presented): A method according to claim 42 wherein said gettering layer comprises a phosphorus silicate glass containing phosphorus at a concentration of 1 to 30 wt%.

Claim 46 (Previously Presented): A method according to claim 42 wherein said gettering layer comprises silicon containing phosphorus at a concentration of 0.1 to 10 wt%.

Claim 47 (Previously Presented): A method according to claim 42 wherein said semiconductor film comprises silicon.

Claim 48 (Previously Presented): A method according to claim 42 wherein said catalyst metal is selected from the group consisting of Ni, Fe, Co, and Pt.

Claim 49 (Previously Presented): A method according to claim 42 further comprising a step of removing said gettering layer after the gettering.

Claim 50 (Previously Presented): A method according to claim 42 wherein said heating to getter the catalyst metal is conducted within a temperature from 500°C to 800°C.

Claim 51 (Currently Amended): A method of manufacturing a semiconductor device having a junction, said method comprising:

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providing a semiconductor film comprising amorphous silicon on an insulating surface;
providing a catalyst metal-containing material on said semiconductor film;
crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and to promote the crystallization thereof;
forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization;

heating said semiconductor film and said gettering layer at a temperature from 500°C to 800°C in order to getter the metal included in said semiconductor film by said gettering layer;
and

forming a doped semiconductor film on said semiconductor film to form a junction.

Claim 52 (Previously Presented): A method according to claim 51 wherein said semiconductor device is a photoelectric conversion device.

Claim 53 (Previously Presented): A method according to claim 51 wherein said heating to getter the metal is conducted for 1-4 hours.

Claim 54 (Previously Presented): A method according to claim 51 wherein said gettering layer comprises a phosphorus silicate glass containing phosphorus at a concentration of 1 to 30 wt%.

Claim 55 (Previously Presented): A method according to claim 51 wherein said gettering layer comprises silicon containing phosphorus at a concentration of 0.1 to 10 wt%.

Claim 56 (Canceled)

Claim 57 (Previously Presented): A method according to claim 51 wherein said catalyst metal is selected from the group consisting of Ni, Fe, Co, and Pt.

Claim 58 (Previously Presented): A method according to claim 51 further comprising a step of removing said gettering layer after the gettering.

H Claim 59 (Currently Amended): A method of manufacturing a semiconductor device having a junction, said method comprising:

providing a substantially intrinsic semiconductor film on an insulating surface;

providing a catalyst metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said catalyst metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization thereof;

heating said semiconductor film and said gettering layer in order to getter the catalyst metal in said semiconductor film by said gettering layer; and

forming a junction using said intrinsic semiconductor film.

Claim 60 (Previously Presented): A method according to claim 59 wherein said semiconductor device is a photoelectric conversion device.

Claim 61 (Previously Presented): A method according to claim 59 wherein said heating to getter the catalyst metal is continued for 1-4 hours.

Claim 62 (Previously Presented): A method according to claim 59 wherein said gettering layer comprises a phosphorus silicate glass containing phosphorus at a concentration of 1 to 30 wt%.

Claim 63 (Previously Presented): A method according to claim 59 wherein said gettering layer comprises silicon containing phosphorus at a concentration of 0.1 to 10 wt%.

Claim 64 (Previously Presented): A method according to claim 59 wherein said catalyst metal is selected from the group consisting of Ni, Fe, Co, and Pt.

Claim 65 (Previously Presented): A method according to claim 59 further comprising a step of removing said gettering layer after the gettering.

Claim 66 (Previously Presented): A method according to claim 59 wherein said heating to getter the catalyst metal is conducted within a temperature from 500°C to 800°C.

Claim 67 (Currently Amended): A method of manufacturing a semiconductor device having a junction, said method comprising:

providing a semiconductor film comprising amorphous silicon formed on an insulating surface;

providing a catalyst metal-containing material on said semiconductor film;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization; and

heating said semiconductor film and said gettering layer in a nitrogen atmosphere in order to getter the catalyst metal contained in said semiconductor film by said gettering layer; and

forming a junction on said semiconductor film.

Claim 68 (Previously Presented): A method according to claim 67 wherein said semiconductor device is a photoelectric conversion device.

Claim 69 (Previously Presented): A method according to claim 67 wherein said heating to getter the catalyst metal is continued for 1-4 hours.

Claim 70 (Previously Presented): A method according to claim 67 wherein said gettering layer comprises a phosphorus silicate glass containing phosphorus at a concentration of 1 to 30 wt%.

Claim 71 (Previously Presented): A method according to claim 67 wherein said gettering layer comprises silicon containing phosphorus at a concentration of 0.1 to 10 wt%.

Claim 72 (Canceled)

Claim 73 (Previously Presented): A method according to claim 67 wherein said catalyst metal is selected from the group consisting of Ni, Fe, Co, and Pt.

Claim 74 (Previously Presented): A method according to claim 67 further comprising a step of removing said gettering layer after the gettering.

Claim 75 (Previously Presented): A method according to claim 67 wherein said heating to getter the catalyst metal is conducted within a temperature from 500°C to 800°C.

Claim 76 (Currently Amended): A method of manufacturing a semiconductor device, comprising:

providing a semiconductor film on an insulating surface;

forming a catalyst metal-containing material on said semiconductor film, said catalyst being a material which facilitates crystallization of said semiconductor film, but which when present in a final product of the semiconductor device degrades operation of the semiconductor device;

crystallizing said semiconductor film by heating in a way that causes said catalyst metal-containing material to diffuse into at least a part of the semiconductor film, said catalyst metal-containing material when so diffused functioning to facilitate said crystallization;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after said crystallization; and

processing said semiconductor film and said gettering layer to remove at least one portion of said catalyst metal in said semiconductor film.

Claim 77 (Canceled)

Claim 78 (Previously Presented): A method as in claim 76, wherein said metal includes Nickel.

Claim 79 (Previously Presented): A method as in claim 76, wherein said catalyst material allows said crystallization to occur at a lower temperature.

Claim 80 (Canceled)

Claim 81 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a semiconductor film on an insulating surface;

providing said semiconductor film with a metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of the semiconductor film;

introducing a gettering material into ~~an entire~~ a surface of said crystallized semiconductor film within a region of 0.1 to 0.2 µm in depth from the surface of the crystallized semiconductor film;

heating said semiconductor film after introducing said gettering material at a temperature from 500°C to 800°C in order to getter the metal in said semiconductor film; and

removing at least said entire surface after gettering the metal in said semiconductor film.

Claim 82 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a semiconductor film doped with boron at a concentration of 0.001-0.1 atm% on an insulating surface;

providing said semiconductor film with a metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization; and

heating said semiconductor film and said gettering layer in order to getter the metal in said semiconductor film by said gettering layer.

Claim 83 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a substantially intrinsic semiconductor film on an insulating surface;

providing said semiconductor film with a metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

introducing a gettering material into ~~an entire~~ a surface of the crystallized semiconductor film within a region of 0.1 to 0.2 µm in depth from the surface of the crystallized semiconductor film;

heating said semiconductor film after introducing said gettering material in order to getter the metal in said semiconductor film; and

removing at least said entire surface after gettering the metal in said semiconductor film.

Claim 84 (Currently Amended): A method of manufacturing a semiconductor device comprising: providing a semiconductor film doped with boron at a concentration of 0.001-0.1 atm% on an insulating surface;

providing said semiconductor film with a metal-containing material;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

introducing a gettering material into ~~an entire~~ a surface of the crystallized semiconductor film within a region of 0.1 to 0.2 µm in depth from the surface of the crystallized semiconductor film;

heating said semiconductor film after introducing said gettering material in order to getter the metal in said semiconductor film; and

removing at least said entire surface after gettering the metal in said semiconductor film.

Claim 85 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a semiconductor film on an insulating surface;

providing a metal-containing material on said semiconductor film;

crystallizing said semiconductor film by heating in a way that causes said metal to diffuse through the semiconductor film and function to promote the crystallization of said semiconductor film;

introducing a gettering material into ~~an entire~~ a surface of the crystallized semiconductor film within a region of 0.1 to 0.2 μ m in depth from the surface of the crystallized semiconductor film;

heating said semiconductor film in a nitrogen atmosphere after introducing said gettering material in order to getter the metal contained in said semiconductor film; and

removing at least said entire surface after gettering the metal in said semiconductor film.

Claim 86 (Currently Amended): A method of manufacturing a semiconductor device having a junction, said method comprising:

providing a semiconductor film doped with boron at a concentration of 0.001-0.1 atm% on an insulating surface;

providing a metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

forming a gettering layer comprising phosphorus over an entire surface of said semiconductor film after the crystallization thereof;

heating said semiconductor film and said gettering layer in order to getter the metal in said semiconductor film by said gettering layer; and

forming a junction using an intrinsic semiconductor film.

Claim 87 (Currently Amended): A method of manufacturing a semiconductor device having a junction, said method comprising:

providing a substantially intrinsic semiconductor film on an insulating surface;

providing a metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

introducing a gettering material into ~~an entire~~ a surface of the crystallized semiconductor film within a region of 0.1 to 0.2 μm in depth from the surface of the crystallized semiconductor film;

heating said semiconductor film after introducing said gettering material in order to getter the metal in said semiconductor film by said phosphorus;

removing at least said entire surface after gettering the metal in said semiconductor film;
and

forming a junction using a doped semiconductor film.

Claim 88 (Currently Amended): A method of manufacturing a semiconductor device having a junction, said method comprising:

providing a semiconductor film doped with boron at a concentration of 0.001-0.1 atm% on an insulating surface;

providing a metal on said semiconductor film;

crystallizing said semiconductor film by heating to cause said metal to diffuse through the semiconductor film and to promote the crystallization of said semiconductor film;

introducing a gettering material into ~~an entire~~ a surface of the crystallized semiconductor film within a region of 0.1 to 0.2 μm in depth from the surface of the crystallized semiconductor film;

heating said semiconductor film and said gettering material in order to getter the metal in said semiconductor film;

removing at least said entire surface after gettering the metal in said semiconductor film;
and
forming a junction using an intrinsic semiconductor film.

Claim 89 (Currently Amended): A method of manufacturing a semiconductor device comprising:

providing a semiconductor film on an insulating surface;
forming a metal-containing material on said semiconductor film, said metal being a material which facilitates crystallization of said semiconductor film, but which when present in a final product of the semiconductor device degrades operation of the semiconductor device;
crystallizing said semiconductor film by heating in a way that causes said metal-containing material to diffuse into at least a part of the semiconductor film, said metal-containing material when so diffused functioning to facilitate said crystallization;

introducing a gettering material into ~~an entire~~ a surface of the crystallized semiconductor film within a region of 0.1 to 0.2 μ m in depth from the surface of the crystallized semiconductor film;

processing said semiconductor film after introducing said gettering material to remove at least one portion of said metal in said semiconductor film; and

removing at least said entire surface of the crystallized semiconductor film after gettering the metal in said semiconductor film.

Claim 90 (Previously Presented): A method according to any one of claims 26, 34, 42, 51, 59, 67, 76 or 81-89 wherein said insulating surface comprises silicon oxide.

Claim 91 (Previously Presented): A method according to any one of claims 26, 34, 42, 51, 59, 67, 76 or 81-89 wherein the concentration of said metal in said crystallized semiconductor film is not higher than 5×10^{18} atoms/cm³.

Claim 92 (Canceled)

Claim 93 (Previously Presented): A method according to any one of claims 26, 34, 42, 51, 59, 67, 76, 81, 85, or 89 wherein said semiconductor film is provided by a plasma CVD method.

Claim 94 (Previously Presented): A method according to any one of claims 26, 34, 42, 51, 59, 67, 76, 81, 85, or 89 wherein said semiconductor film is provided by a low pressure CVD method.

Claim 95 (Previously Presented): A method according to any one of claims 26, 34, 42, 51, 59, 67, 76, 81, 85, or 89 wherein said semiconductor film is provided by a sputtering method.

Claim 96 (Previously Presented): A method according to any one of claims 82-89 wherein said heating or processing to getter the metal is conducted within a temperature from 500°C to 800°C.

Claim 97 (Previously Presented): A method according to any one of claims 81-89 wherein said semiconductor device is a photoelectric conversion device.

Claim 98 (Previously Presented): A method according to any one of claims 81-89 wherein said heating or processing to getter the metal is conducted for 1-4 hours.

Claim 99 (Previously Presented): A method according to any one of claims 81-89 wherein said metal is selected from the group consisting of Ni, Fe, Co, and Pt.

Claims 100-102 (Canceled)

Claim 103 (Previously Presented): A method according to any one of claims 26, 34, 42, 51, 59, 67, 76, 82, or 86 wherein said gettering layer is formed by a CVD method.

Claim 104 (Previously Presented): A method according to any one of claims 81, 83-85, or 87-89, wherein said gettering material comprises phosphorus.

Claim 105 (Currently Amended): A method according to any one of claims 81, 83-85, or 87-89, wherein said gettering element material is introduced by a plasma doping method.

Claim 106 (Previously Presented): A method according to any one of claims 26, 34, 42, 51, 59, 67, 76, 82, or 86, wherein said gettering layer is in contact with said semiconductor film.

Claim 107 (New): A method according to any one of claims 81, 83-85, or 87-89, wherein said gettering material is introduced into an entire surface of the crystallized semiconductor film.